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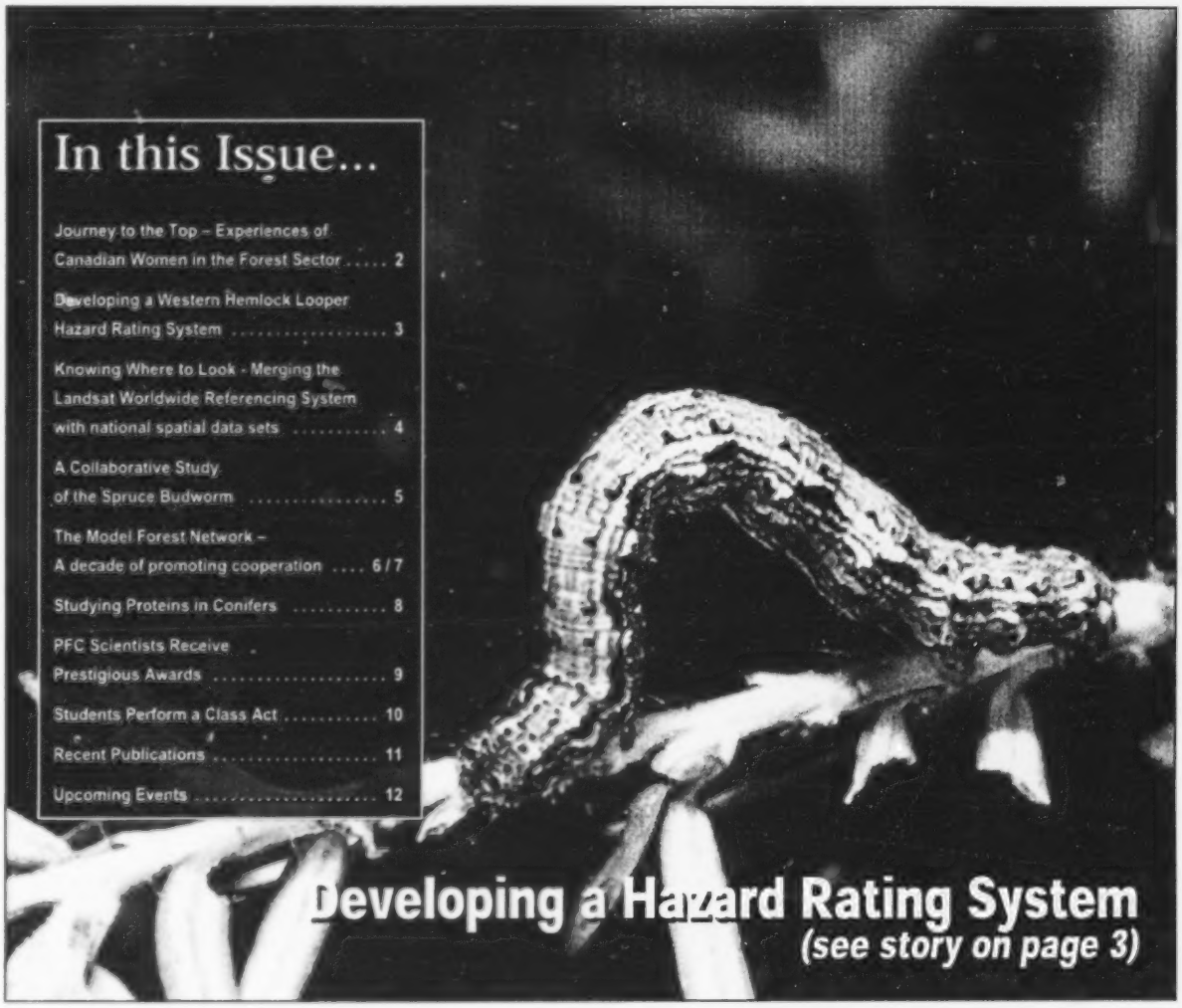

Developing a Hazard Rating System
(see story on page 3)

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Journey to the Top - Experiences of Canadian Women in the Forest Sector

"National statistics show that women continue to be under-represented in the field of forestry."

The role of women in the forestry sector in Canada has changed dramatically over the past 15 years leading into the new millennium. There's been a shift from the more traditional subordinate supporting role to one of women moving into management and decision-making positions.

A recent study by Elaine Teske (**available at eteske@pfc.cfs.nrcan.gc.ca**), Director of Programs, Planning and Operations at the Canadian Forest Service, Pacific Forestry Centre, and Bronwen Beedle, Assistant Deputy Minister, BC Ministry of Forests, examined the contribution of women in defining the Canadian forestry agenda. The women who were interviewed for the study work in senior positions in varying jurisdictions — government, industry, academia, and as consultants. Their perspectives on how the journey to the top was progressing, the challenges they faced, and the factors affecting this journey were the focus of this study.

"National statistics show that women continue to be under-represented in the field of forestry as university students, in academia, in operations, and in all facets of the forest sector," says Teske. "According to Statistics Canada, 16 percent of those employed in the forest sector today are women, well below the overall average of 45 percent for all occupations. And the Association of British Columbia Registered Professional Foresters reports that between 1995 and 2000 the percentage of women professional foresters modestly increased to 14 percent from 10 percent."

Women in forestry are optimistic that the path to career advancement is clearer now than ever before.

Since there was a dearth of statistics related to this issue, the authors relied heavily on primary research. According to those surveyed, formal and continuing education as well as the influence of a mentor played the most significant roles in advancement. Eighty-five percent of the interviewees had an undergraduate degree, 55 percent had a Masters degree, and 26 percent had earned a Doctorate. Fully 100 percent had taken continuing education training, most frequently in communication, leadership and human resource management. Women ranked the role of a mentor as the most important influence on their careers. Most respondents relied on male mentors due to a lack of female role models during their formative years. Not surprisingly, the women who benefited most from mentors have chosen to be mentors to others.

"Over 75 percent of those surveyed encountered barriers to success along the way relating to gender, age, pay inequity and factors related to balancing career and family," says Beedle. "Many felt employment equity programs, which are more prevalent in the public sector, can work against women if used to meet a pre-determined quota. As well, some 39 percent of respondents felt they were not being treated equitably on the pay scale. This was particularly true in academia and industry. In Canada the average income for women across all occupations in 1999 was 73 percent of that for men."

The values of networking and belonging to professional associations are also discussed in the study. Having the time to commit to these initiatives was a limiting factor for most interviewed, given many were still balancing careers with raising families or taking care of elderly parents.

"However, despite the challenges, nearly 80 percent felt it was easier to get ahead in the 90s than previously, with women citing perseverance and a willingness to take risks as the critical factors to career advancement and achievement of success," adds Teske.

The women interviewed in the study are optimistic that the path to career advancement is clearer now than ever before, made easier by those who have gone before them coupled with improvements in public attitudes on traditional employment. Most agreed that having both men and women work together, equally valued for their contributions, is the best approach to tackling some of the remaining challenges.

A complete copy of the study, prepared for the joint FAO/ECE/ILO Committee on Forest Technology, Management and Training held in Portugal in April 2001, can be obtained through the Canadian Forest Service Bookstore at http://bookstore.cfs.nrcan.gc.ca.

Developing a Western Hemlock Looper Hazard Rating System

"We anticipate that the hazard rating system will aid forest managers in dealing with western hemlock looper outbreaks."

Cover story — the western hemlock looper.

Over the past century there have been 14 western hemlock looper outbreaks in BC, each resulting in severe defoliation and tree mortality. And now its numbers are on the rise again.

The last hemlock looper outbreak in the province lasted from 1990 to 1995 and caused tree mortality over 63 000 hectares and a further 272 000 hectares were severely defoliated. Outbreaks generally start in the favoured host tree, mature western hemlock. Once these stands are defoliated, the insect feeds on other species such as western redcedar, Douglas-fir and western white pine. In an attempt to determine areas susceptible to looper outbreak and to forecast where and when outbreaks occur, the Canadian Forest Service is creating a western hemlock looper hazard rating system. An ability to identify and monitor susceptible areas will aid forest managers in their decision-making process.

"Although forest managers most likely have already identified problem areas, a western hemlock looper hazard rating system will provide them with an accurate definition of areas at risk," says Dr. Imre Otvos (**available at: iotvos@pfc.cfs.nrcan.gc.ca**), a research scientist at the Pacific Forestry Centre. "Such a system may also allow for the implementation of preventative silviculture. Following harvesting, areas that are known to harbour looper outbreaks may be replanted with non-hosts or trees that are less suitable to the looper."

Adds Neil Borecky (**available at: nborecky@pfc.cfs.nrcan.gc.ca**), a GIS analyst at the Pacific Forestry Centre, "Initially, we developed a coarse-scale risk rating system – a province-wide hazard assessment on a 2-km grid scale. This grid was developed to identify similar traits among regions that have experienced a looper outbreak in the past and to exclude areas that possess no risk."

Frequency maps indicate that western hemlock looper outbreaks occur most often in the Coastal Western Hemlock and Interior Cedar Hemlock biogeoclimatic zones. Building on this information, the hazard rating system defines regions that share common characteristics with areas that have experienced outbreaks in the past. Parameters such as elevation, age class, and basic climate data have been compared throughout the province. It appears that, generally, areas that are at risk to outbreaks contain mature hemlock (over 120 years old), are below 56°N latitude, and have more than average amounts of precipitation.

Such information aids in determining placement of permanent pheromone traps (traps baited with a mixture of synthetic sex pheromones that attract only male looper moths). For the last decade, 23 pheromone traps located in high hazard biogeoclimatic zones in BC have been used to follow population trends of the western hemlock looper. Site-specific information such as population levels, monitored through larvae sampling and counts of looper males caught in traps, will contribute to accurate outbreak forecasts.

"We hope to follow changes in looper population through an entire outbreak cycle so we can understand what the number of pheromone trap catches mean and what larval numbers indicate," says Dr. Otvos. "The threshold level of these two counts would aid in forecasting outbreak occurrences."

"Now that we have a province-wide hazard assessment, we are near completion of detailed risk assessment ratings at the stand level," says Borecky. "Various models that incorporate local weather conditions, biogeoclimatic zones, and tree stand characteristics are being evaluated. Based on these results, current pheromone trap locations will be examined and expanded if necessary. In addition, we will be able to assess the risk of an outbreak occurring in a particular forest stand at the operational level."

Adds Dr. Otvos, "The aim of creating a system to predict western hemlock looper outbreaks is an attainable goal. Once complete, we anticipate that the hazard rating system will aid forest managers in dealing with western hemlock looper outbreaks in an effective fashion, both through direct and indirect pest management methods."

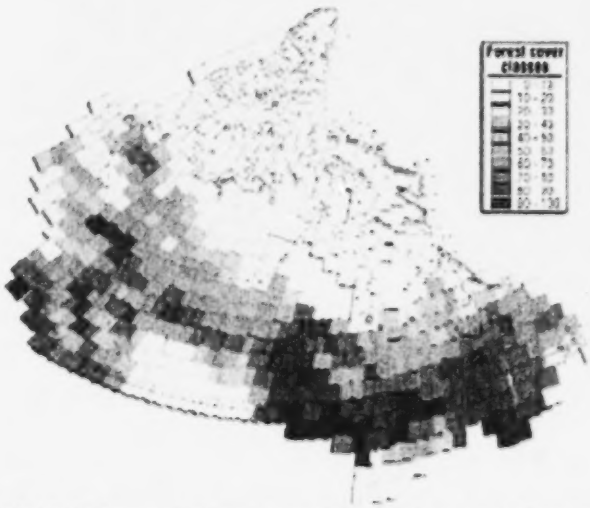
Knowing Where to Look

Merging the Landsat Worldwide Referencing System with national spatial data sets

"Fusing the Landsat Worldwide Referencing System with spatial data will be invaluable as a planning tool and a data management tool."

Any artist will tell you that you'll lose perspective if you're too close to your work. You have to step back and get the view from a distance to really understand what you're doing. In the same sense, by providing images from space, the Landsat satellite provides information about the earth's resources. But, just as studying every drop of paint on the canvas would be unnecessary and overwhelming to the painter, searching hundreds of images from Landsat can be overwhelming and time-consuming.

The Landsat Worldwide Referencing System organizes and catalogues the massive amount of data collected by partitioning the globe into frames. But each of these frames contain thousands of pixels which require further examination to determine the characteristics of the image. Dr. Mike Wulder (**available at mwulder@pfc.cfs.nrcan.gc.ca**), a research scientist at the Pacific Forestry Centre, has merged these frames with national spatial data sets such as those representing Canada's land cover, elevation, and population characteristics. This provides general information about each frame – a summary of the country's national trends frame by frame. Researchers can now make queries within specific areas rather than be burdened by exhaustive study in unrelated areas.



Worldwide Referencing System over Canada where each frame is shaded in reference to percent of forest cover. Forest cover information is from the Northern Biosphere Observation and Modelling Experiment land cover map of Canada.

"The summarization of more coarse spatial data within each Landsat frame provides us with an indication of the expected contents nationally, on a frame-by-frame basis," explains Dr. Wulder. "For example, there are over 1200 overlapping frames covering Canada's land mass. Of these, approximately 434 frames are expected to represent areas which are expected to have greater than 10 percent forest cover. By querying for percent forest cover, we have an indication of where the forested areas are and can prioritize image acquisition and analysis accordingly."

A spatial view of the environmental, topographic and social characteristics of the country makes image selection easier than simply having a list of Landsat images. It also aids with image cataloguing, organizing of processing, and the development of sampling techniques.

Fusing the Landsat Worldwide Referencing System with spatial data will be invaluable as a planning tool and a data management tool for such projects as the Earth Observation for Sustainable Development of Forests (EOSD). Basically, EOSD is a long-term project to monitor Canada's forests using space-based technology. Part of this project is the mapping of the country's forests using Landsat data. A frame-by-frame summary of forested areas and other characteristics would greatly enhance the development of EOSD.

"There is a wide variety of queries and analyses that can be undertaken once the national data sets are described," adds Dr. Wulder. "Once the frames are populated with data, more complex queries can be developed that combine the new information with existing spatial data sets. For instance, the Worldwide Referencing System frames may be intersected with maps indicating the location of national parks. Once this is done, the frames that intersect with the parks can be queried for contents and considered for additional analysis."

Joanne White, a GIS/remote sensing analyst at Timberline (a company providing remote sensing, GIS and resource consulting services in western and central Canada), finds that the database aids in performing her work. "It is normally a very cumbersome process to identify which Landsat images correspond to a client's area of interest. With the Worldwide Referencing System database we may simply

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A Collaborative Study of the Spruce Budworm

"These results will help forest managers plan more sustainable management systems based on the natural disturbance pattern that the budworm creates."

Spruce budworms helping themselves to a meal can cause big problems for a forest and even bigger problems for forest managers.

Early in the spring, spruce budworm larvae emerge and start munching on last year's needles and the new buds of spruce and balsam trees of BC. They defoliate the tree, often causing it to die. When entire stands are affected, forest managers must act quickly to salvage the timber from the killed trees before weather and fungal diseases lessen its value.

With the budworm on the rise in an area of northern BC, a team of researchers set out to determine what makes a forest susceptible to this hungry caterpillar and how it affects the forest ecosystem in the long-term. Natural disturbances such as this spruce budworm infestation are necessary for maintaining a forest's ecological balance. Details about this balance, and determining what factors put a stand at risk, allow forest managers to base their management system on natural dynamics, and to predict and plan for the effects. If they know when and where the budworm may strike next, they can plan harvests and treatments to keep it in check and get the most value from the timber supply.

The team of researchers began the first study in the Fort Nelson District of the Prince George Forest Region in 1992. Building on what they learned in that study, they expanded the research area and started a second study last year to look further at the risk factors and effects of spruce budworm infestation.

"In the first study, we looked at 17 stands over five years to identify forest characteristics associated with increased susceptibility to spruce budworm defoliation," says Dr. René Alfaro (**available at ralfaro@pfc.cfs.nrcan.gc.ca**), a research scientist with the Canadian Forest Service, Pacific Forestry Centre. "Now we are studying this further by adding 14 more study stands and focusing on how the spruce budworm affects the long-term dynamics of these forests."

Photo by Troy Lockhart, BC Ministry of Forests.

Budworm-attacked white spruce trees at Kledo Creek, west of Fort Nelson.

Dr. Alfaro worked on this study with other Canadian Forest Service researchers, Angus Shand, Dr. Don Leckie, Dr. François Gougeon and Dr. Steen Magnussen, and in collaboration with the BC Ministry of Forests and Slocan Forest Products.

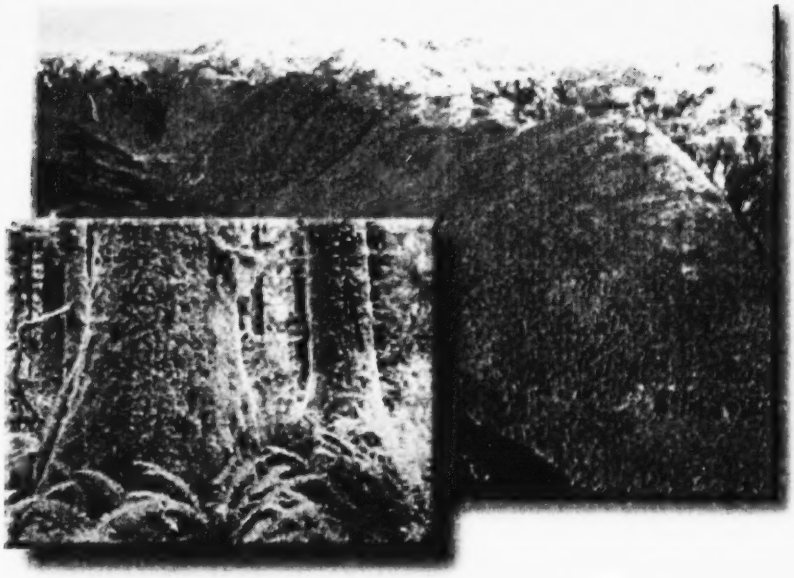
"This continuing research project is critical in predicting where the outbreaks will occur and the potential long- and short-term impacts to harvesting and annual allowable cuts," says Myles Thorp, Ministry of Forests Operations Manager for the Fort Nelson Forest District.

The first study showed that susceptibility to spruce budworm infestation is associated with several forest characteristics. Susceptibility was higher for stands where the main tree species was white spruce, or where spruce was mixed with aspen. Site quality, level of crown closure and stand age also played a role in susceptibility. Spruce stands of medium quality were more susceptible than poor and high quality sites. On the spruce and aspen mixed sites, the higher quality sites were more susceptible than the low quality ones. For crown closure, the open sites with less than 50 percent closure were more susceptible than the ones with closed canopies. Older stands with trees from 120 to 199 years old were more susceptible than the younger ones with trees from 40 to 110 years old. Landscape analysis, under the direction of Dr. Magnussen, will seek to expand these findings by considering additional factors which increase budworm risk, such as terrain features and climate.

In the current study, the aim is to determine the historic occurrence of budworm infestation in the area, using remote sensing methods to measure the extent and intensity and to determine the landscape patterns that contribute to susceptibility. The team will look at the budworm's effect on rate of attrition and growth of the trees. They'll also look at the effects of the defoliation on the understory vegetation, snag availability and coarse woody debris, which are important habitat for many animals. These results will help forest managers plan more sustainable management systems based on the natural disturbance pattern that the budworm creates.

The Model Forest Network — A

"It is about more than trees – it's about people and how they relate to forest resources around them."



The Long Beach Model Forest on the west coast of BC.

In a world of diverse and complex forest ecosystems, forest management methods vary greatly. But there is one almost universal objective: To create a balance between the often competing objectives of economic growth, social stability and environmental integrity, and to ensure that forest ecosystems remain available for future generations. For the past ten years, the International Model Forest Network has been addressing this challenge through promoting cooperation on a local, national and international scale.

Initiated by the Government of Canada in the 1990s, the International Model Forest Network consists of representatives with a diversity of forest values. Environmental organizations, native groups, industry, educational and research institutions, all levels of government, community-based associations, recreationists, and landowners work together to generate ideas and research on-site solutions to sustainable forest management issues. Located in numerous countries world-wide, each model forest has developed a common vision particular to their forest ecoregion, and practices conservation methods necessary to sustain them.

"Basically, a model forest is where people from a variety of backgrounds who have a direct interest in the forest gather to make decisions based on the latest scientific and technological research including traditional knowledge," explains Fred Johnson, Executive Director of the International Development Research Centre, which sponsors the International Model Forest Secretariat in Ottawa. "Model forests deal with a wide variety of issues specific to their location, whether it be conservation of threatened or endangered species, organic agriculture and agroforestry, or the development of an economic base around non-timber forest products. It is about more than trees – it's about people and how they relate to forest resources around them. It's about increasing the benefits that forests provide and at the same time addressing environmental and conservation issues."

Model forests can also deal with issues such as cross-cultural awareness among indigenous and non-indigenous communities, environmental education in schools and in the workforce, and the application of new technologies such as GIS, GPS, and biotechnology. Through the International Model Forest Network, model forests share their knowledge, experience, and technology with other model forests world-wide.

One means of communicating information is through the "twinning" of established model forests with developing ones. The established model forest acts as a mentor in

A Decade of Promoting Cooperation

terms of assisting with planning, operations, training and technology transfer activities.

In Canada, there are eleven established model forests located in nine provinces covering more than 8.3 million hectares of territory. The Canadian Model Forest Network, supported by the Canadian Forest Service, reflects a variety of land ownership including private woodlots, large industrial forests (either privately owned or owned by the Crown), as well as protected areas such as parks, wilderness preserves and conservation areas. Many of these model forests in Canada have been twinned with developing model forests in other countries.

"The McGregor Model Forest here in BC has been twinned to a Russian model forest and the Long Beach Model Forest has been connected with a model forest in Chile," says Dr. Bill Wagner (**available at wiwagner@pfc.cfs.nrcan.gc.ca**), model forests coordinator at the Canadian Forest Service, Pacific Forestry Centre. "Another example of twinning is the Manitoba Model Forest which has been sharing its research on the monarch butterfly through exchange programs set up with a model forest in Mexico that has the same butterfly."

Communication among model forests includes monitoring the effects of management practices against a set of criteria and indicators. The Canadian Model Forest, for example, uses a framework of six criteria for sustainable development as defined by the Canadian Council of Forest Ministers:

- Conservation of biological diversity
- Maintenance and enhancement of forest ecosystem condition and productivity
- Conservation of soil and water resources
- Forest ecosystem contributions to global ecological cycles
- Multiple benefits of forests to society
- Accepting society's responsibility for sustainable development

"Building on this set of criteria, each model forest in the country has developed a suite of local level indicators of sustainable forest management specific to its environment," adds Dr. Wagner. Some of the activities undertaken by a few of the model forests in Canada as part of this initiative are listed in the sidebar.

One example of how these local level indicators in the Canadian Model Forest Network are shared among the International Model Forest Network is through an Internet tool called SIMFOR, or Socioeconomic Indicators for the Model Forest Network. The site allows users to compare related forestry information among Canadian model forests through creating thematic maps, generating graphs, and downloading socioeconomic profiles.

The network is now in its tenth year, and the Canadian Forest Service is likely to renew support for the Canadian Model Forest Network for another five years. Further information about the Canadian Model Forest Network is available at http://www.modelforest.net/. The International Model Forest Network web site is at http://www.idrc.ca/imfn/.

A representative sample of Canadian Model Forests and some of their successes

Model Forest	Some accomplishments and ongoing projects
Western Newfoundland Model Forest • 923,000 hectares in western Newfoundland	• Helped establish a pine marten reserve • Researching the impact of forestry on the pine marten population • Established a unique training program for front-line forest workers • Supporting the Summer Institute in Environmental Education
Lake Abitibi Model Forest • 1.2 million hectares in northeastern Ontario	• Created, with First Nations, an extensive inventory on the cultural heritage of the area • Prepared and presented a series of science articles to local media • Prepared a Community Development Impact Model
Long Beach Model Forest • 400,000 hectares in western Vancouver Island, BC	• Planning climate and hydrometric monitoring • Held a workshop with First Nations about Nuu-chah-nulth naturalized knowledge • Implementing a data management strategy

Studying Proteins in Conifers

"A greater understanding of conifers at the genetic level will pave the way to better survival rates of forest stands."

Sometimes scientists get a bad rap. They're accused of searching for results to support their hypotheses while dismissing those that do not. But it's an unfair accusation. Actually, it has been the open-mindedness of researchers that has led to many discoveries that we now take for granted.

Tunnel vision is uncommon in the field of forest research. Due to the many years it takes for a tree to mature, results can be a long time coming. Therefore, although negative results are considered integral to research in all sciences, inconsistencies and anomalies may receive even closer attention in forest research. Canadian Forest Service scientist Dr. Abul Ekramoddoullah's (**available at aekramoddoullah@pfc.cfs.nrcan.gc.ca**) current work in protein chemistry exemplifies this phenomenom.

In the last few years, Dr. Ekramoddoullah has been gaining international recognition for sequencing the gene that produces a protein linked to frost-hardiness in BC's western white pine. This natural "anti-freeze" allows the tree to survive winter temperatures by preventing the formation of freeze-induced damaged cells. Researchers have since wondered if the same proteins are responsible for frost tolerance in other conifers.

A research technician in the process of characterizing a Douglas-fir gene.

"We were studying resistance to white pine blister rust when we made the "cold" protein discovery," says Dr. Ekramoddoullah, working at the Pacific Forestry Centre. "And since then we've been researching the same proteins in Douglas-fir to see if they are also responsible for frost-hardiness in that species. Results from these studies have led us back to studying fungal resistance."

Although seasonal variation studies of the protein in Douglas-fir genes indicate a connection between the protein and overwintering, there is no indication that the protein is associated with frost-hardiness as it is in western white pine. However, past research suggests that cold hardening may increase a plant's resistance to fungal infection. In fact, Dr. Ekramoddoullah found that the "cold" protein in white pine was up-regulated or expressed when infected by white pine blister rust. He then wondered if his current studies with Douglas-fir could also indicate a protein related to fungal infection.

"We found that although the protein does not seem to be related to frost-hardiness, we did find it was up-regulated by pathogens such as the laminated root rot fungus, *Phellinus weirii*," explains Dr. Ekramoddoullah. "Using a novel inoculation technique, Rona Sturrock (a Pacific Forestry Centre research scientist and laminated root rot expert) found evidence of genetically based resistance to the fungus. We now want to see if genetic resistance could be a management strategy to combat fungal infection."

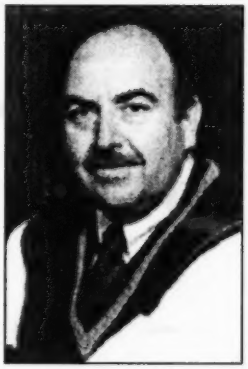
The researchers are now looking at the promoter, or the parts of the gene that control the gene, to see which part regulates response to cold and which regulates a response to fungal infection. Doing so may help to screen for resistance to the fungus.

The fungus, *Phellinus weirii*, is the most serious root pathogen affecting coastal Douglas-fir in western North America. If not removed from infected stumps and roots, the fungus continues to grow and cause laminated root rot in subsequent generations of susceptible conifers. A greater understanding of conifers at the genetic level will pave the way to better survival rates of forest stands.

Pacific Forestry Centre Scientists Receive Prestigious Awards

"These scientists are internationally respected for their forest research."

Dr. Caroline Preston



Dr. René Alfaro

Canadian Forest Service researchers Dr. René Alfaro and Dr. Caroline Preston have recently received award recognition for their outstanding work. Working at the Pacific Forestry Centre, these scientists are internationally respected for their forest research.

Distinguished Contributions

Dr. Preston (**available at cpreston@pfc.cfs.nrcan.gc.ca**) has been honoured with the Clara Benson Award by the Canadian Society of Chemistry for her work on the chemistry of soil organic matter. Supported by the Council of Canadian University Chemistry Chairs, the award recognizes distinguished contribution to chemistry by a woman while working in Canada.

Dr. Preston uses chemical techniques to study nitrogen cycling and organic matter in both natural and managed forest ecosystems. The nitrogen work uses labelling with the stable isotope N-15 to follow the movement and transformations of nitrogen. Two areas of special interest are the long-term fate of applied fertilizer nitrogen (up to 10 years), and measurement of biological nitrogen fixation by alder. The organic matter studies make extensive use of nuclear magnetic resonance spectroscopy to characterize carbon-based components and their transformations in litterfall, forest floor, mineral soil organic matter, and dissolved organic carbon, including the ecological role of tannins.

Most of Dr. Preston's work has involved a variety of coastal and interior ecosystems in BC, with special emphasis on the Shawnigan Lake Douglas-fir site on Vancouver Island, and the Salal-Cedar-Hemlock Integrated Research Program which investigates problems of nutrient limitation and vegetation competition in cedar-hemlock cutovers of northern Vancouver Island.

A research scientist since 1978, Dr. Preston's most recent work concerns climate change and fire in the boreal forests of both Canada and Russia. She spent the summer of 2000 on expedition to Siberia, examining soil carbon in relation to disturbance and the implications of global warming. Dr. Preston has been involved with many international research collaborations, including being an eminent visiting scientist with Queensland Forestry in Brisbane, Australia. In 1992, she was awarded the Barringer Prize by the Canadian Spectroscopy Society for her work in applied spectroscopy, and she is an adjunct professor in the Department of Forest Sciences at the University of British Columbia.

Outstanding Achievements

Dr. Alfaro (**available at ralfaro@pfc.cfs.nrcan.gc.ca**) is the 2001 recipient of the Canadian Forestry Scientific Achievement Award. The Canadian Institute of Forestry recognizes individuals who have made outstanding achievements in forestry research in Canada.

As a research scientist in forest entomology, Dr. Alfaro contributes to the understanding of insect pests, their interaction with host trees, and the impact that they have on forest productivity and sustainability. His research results have been used in the formulation and application of forest policy and in the development of integrated pest management as a component of integrated forest resource management in Canada.

Dr. Alfaro's application of dendrochronological analyses to determine past and present impact of forest defoliators allows foresters to make knowledge-based pest management decisions and to incorporate anticipated losses into forest resource planning. His work on the elucidation of the resistance mechanisms in spruces to the white pine weevil has lead to the selection and propagation of resistant stock and the resurrection of Sitka spruce as a viable species for reforestation. Dr. Alfaro has developed an integrated pest management program for the white pine weevil and has developed and implemented a computerized spruce Weevil Attack Decision Support system, the first of its kind in Canada.

In 1990, Dr. Alfaro received the Scientific Achievement Award by the International Union of Forestry Research Organizations (IUFRO) and in 1995 the Canadian Forest Service Merit Award for Scientific Excellence. Internationally, Dr. Alfaro has lead research projects in Chile, Argentina and Brazil and was a guest speaker at the World Forestry Congress in Turkey in 1997. Dr. Alfaro is the leader of the IUFRO Entomology Section, a unit including ten entomology working groups.

Students Perform a Class Act

"The lab has greatly benefited through hiring exceptional students."

The Canadian Forest Service has long been a source of employment for students. Summer, graduate and post-graduate students working at the Pacific Forestry Centre augment their formal training and gain practical experience in a scientific environment.

One such student is Gurp Thandi who spent this past summer describing temporary ecosystem survey plots and identifying potential locations for permanent measurement plots to be used in measuring ecosystem carbon stocks and fluxes. The plots are located in the Courtenay and Campbell River areas where the University of British Columbia has established carbon flux towers to measure net CO_2 uptake, heat transfer and evaporation within specific forest stands.

"I was working for Dr. Tony Trofymow, a research scientist at the Pacific Forestry Centre who was looking to establish the permanent plots within the measurement footprint of the flux towers," explains Thandi. "Using GIS coverages provided by TimberWest and Weyerhaeuser, as well as numerous government and Internet sources, I created maps that delineated the areas based on biogeoclimatic zone, forest type, forest age, contours, drainage networks and road access. Upon reviewing the maps, Dr. Trofymow suggested which areas I should consider for the temporary plots."

Thandi then went into the field and performed site, vegetation, coarse woody debris, soil, and mensuration assessments. This provided more specific information on the ecosystem types within the tower sites and was used to determine potential locations for the permanent plots.

James Anderson uses a compass and GPS to find data collection field plots.

Thandi says that although his studies in environmental technology at Camosun College provided some experience in the area, work at the Pacific Forestry Centre greatly enhanced his understanding of the field.

"One of the best parts about the job is that the professionals you work with express confidence in you and that sparks confidence in yourself which inspires you to do your best. It's a great job and I really enjoyed working there."

James Anderson and Chris West, two university students who worked in remote sensing, express similar sentiments.

"I like the fact that I was working in the scientific realm of computers rather than using them for solely commercial purposes where you're worried only about the bottom line," says Anderson, who is pursuing an undergraduate degree in computer science and physics. "I fully enjoyed my time at the Pacific Forestry Centre, both in terms of the work I was doing and the friendly atmosphere created by the other employees."

Both Anderson and West were working in the Advanced Forest Technologies lab at the Pacific Forestry Centre where, under research scientist Dr. David Goodenough, satellite and aircraft imagery are used to determine information about the state of Canadian forests. The students carried out field measurements for validating remotely sensed data obtained over the Greater Victoria Watershed District, an area approximately 15 by 23 km on south Vancouver Island, BC.

"Basically, we collected foliage samples from a system of plots in the watershed and sent them for chemistry analysis," explains West, a computer science student. "This information was combined with leaf area index and field spectral measurements and used to correspond the satellite imagery with what is actually on the ground. By corresponding the data this way, remotely sensed images can be applied to other areas to determine forest attributes without the need for ground samples."

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Recent Publications

The structure and economic contribution of secondary manufacturing in British Columbia, 1990-1999. 2001. Wilson, W.J.; Stennes, B.; Wang, S.; Wilson, L. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. BC-X-390. 56 p.

Directory of secondary manufacturing of wood products in British Columbia. 2001. Wilson, W.J.; Stennes, B. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. BC-X-389. 230 p.

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Students perform a class act

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Collecting foliage samples is something Grace Sumampong understands. As a graduate student, Sumampong has spent many days in the field this past summer collecting leaves from such plants as the weedy *Rubus spectabilis*, or salmonberry. She is working for Dr. Simon Shamoun, a research scientist at the Pacific Forestry Centre who is developing a biological control agent for the plant. Sumampong is studying fungi that are native pathogens to salmonberry.

There are over 400 isolates of fungi found along coastal BC that Sumampong is screening and selecting for their potential as an effective biocontrol formulation. She is also studying the genetic makeup of the salmonberry to determine the homogeneity within the species. Differences apparent at the molecular level can determine how susceptible or resistant a plant is to infection.

"I'm doing DNA fingerprinting to determine the diversity among the *Rubus spectabilis* population," says Sumampong. "Studying the biology of plants is fascinating, especially at the Pacific Forestry Centre where there is vast expertise available and the facilities are excellent. I really enjoy my work here."

Over the years, student employment at the Pacific Forestry Centre has been a positive experience not only for students, but the lab has greatly benefited through hiring exceptional students.

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Knowing Where to Look...

(continued from page 4)

overlay our clients boundaries with the image grid and instantly know which images cover our study area and to what extent (full or partial) the coverage is. I have not tapped into all of the other attributes and functionality which the system supports and this is largely because my clients already have specific areas of interest. The WRS catalogue offers great utility for those who are looking to study a particular feature or attribute and need to know where they can find it and what Landsat image or images would be best suited to their investigation."

To access and query the database, go to http://pfc.cfs.nrcan.gc.ca/profiles/wulder/wrs.

Upcoming Events

The BC Community Forestry Forum: Exploring Policy and Practice
March 14 – 16, 2002
Victoria, BC, Canada

The BC Community Forestry Forum is designed to explore the practice of community forestry and the policies required to support it. While the primary focus of the forum will be on BC, an examination of community forestry policies and practices from across Canada and other countries will be included. The forum will provide an opportunity to address conceptual and policy questions as well as to examine practical aspects of community forestry.

For more information, check the web site at: http://www.cf-forum.org or contact
Brian Egan, Research Associate, University of Victoria,
Tel: (250) 472-4487; Fax: (250) 472-5060;
E-mail: brian@forestsandcommunities.org

IUFRO Silviculture Conference
Mountains Forests: Conservation and Management
July 29 – August 2, 2002
Vernon, BC, Canada

The conference will provide a forum at which forest researchers and practitioners from around the world can present and discuss the latest findings from their research on mountain forests and management issues. Emphasis will be on silvicultural challenges and solutions.

For further information, check the web site at http://www.mountainforests.net or contact
Tom Rankin, Forest Continuing Studies Network,
Tel: (250) 573-3092; Fax: (250) 573-2882;
E-mail: Tom.Rankin@fcsn.bc.ca

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